

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc DEGREE EXAMINATION DECEMBER 2018
(Third Semester)

Branch – MATHEMATICS

MECHANICS

Time: Three Hours

Maximum: 75 Marks

Answer ALL questions
ALL questions carry EQUAL marks (5 x 15 = 75)

- 1 a State and prove Lagrangian form of D'Alembert's principal. (7)
- b A particle of mass m suspended by a massless wire of length $r = a + b \cos \omega t$ ($1 > b > 0$) to form a spherical pendulum. Find the equations of motion. (8)

OR

- c State and prove Konig's theorem. (10)w
- d Derive the angular momentum of system. (5)
- 2 a Find the differential equation of motion for a spherical pendulum of length l . (7)
- b Obtain the standard form of Lagrange's equation for a holonomic system. (8)

OR

- c Derive the Lagrange's equation using Routhian function. (8)
- d Write short notes on ignorable coordinates. (7)
- 3 a Derive the Euler-Lagrange equation of stationary value. (8)
- b Find the stationary values of the function $f = z$ subject to the constraints $\phi_1 = x^2 + y^2 + z^2 - 4 = 0$; $\phi_2 = xy - 1 = 0$. (7)

OR

- c Derive the Hamilton's canonical equations of motion. (8)
- d Find the equation of motion using Hamiltonian procedure given that a mass spring system consisting of a mass m and a linear spring of stiffness k and assume that the displacement x is measured from the unstressed position of the spring. (7)
- 4 a Express the first pfaffion's system. (5)
- b Derive the Hamilton – Jacobi equation. (10)

OR

- c State and prove Stackel's theorem. (10)
- d Derive modified Hamilton – Jacobi equation. (5)
- 5 a Show that the transformation $Q = \frac{1}{2}(q_2 + p^2)$ and $P = -\tan^{-1} \frac{p}{q}$ is canonical. (8)
- b Obtain the four major types of generating functions associated with the transformation $Q = \log \frac{\sin p}{q}$ and $P = q \cot p$. (10)